

Recovery of Associated Gas for independent power generation (IPP)

**OKPAI
NIGERIA**

Giorgio Vicini

Natural Gas as a Climate Change Solution

IPIECA Workshop

26-28 September 2006

CONTENT

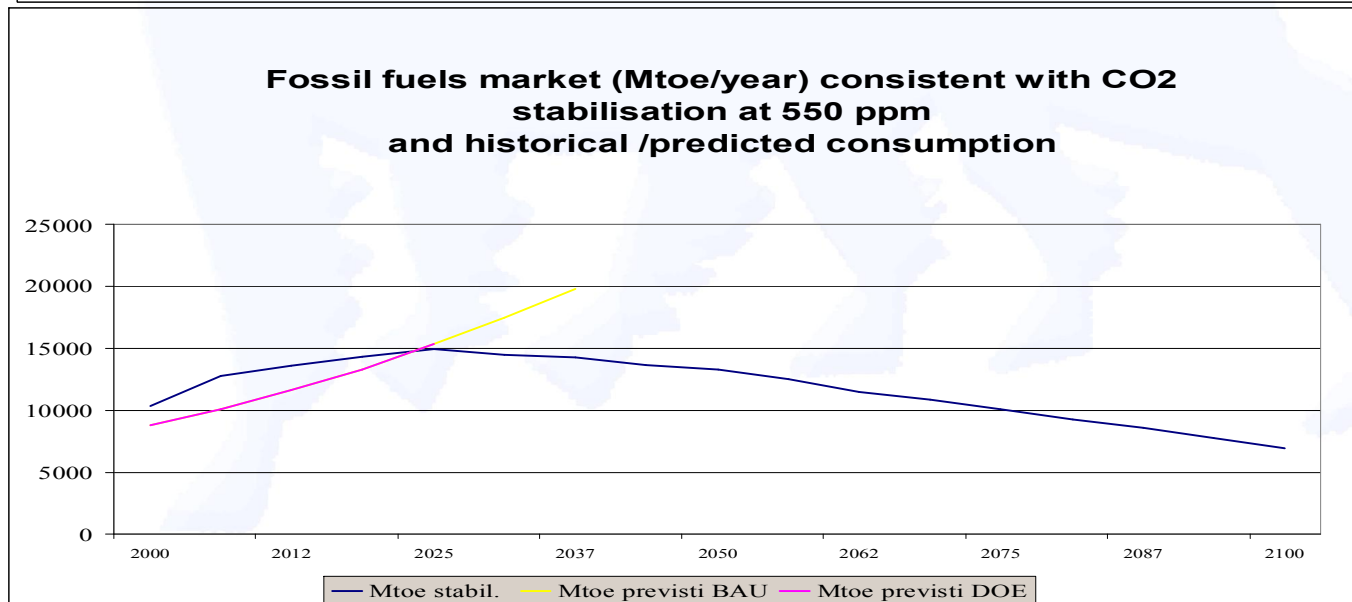
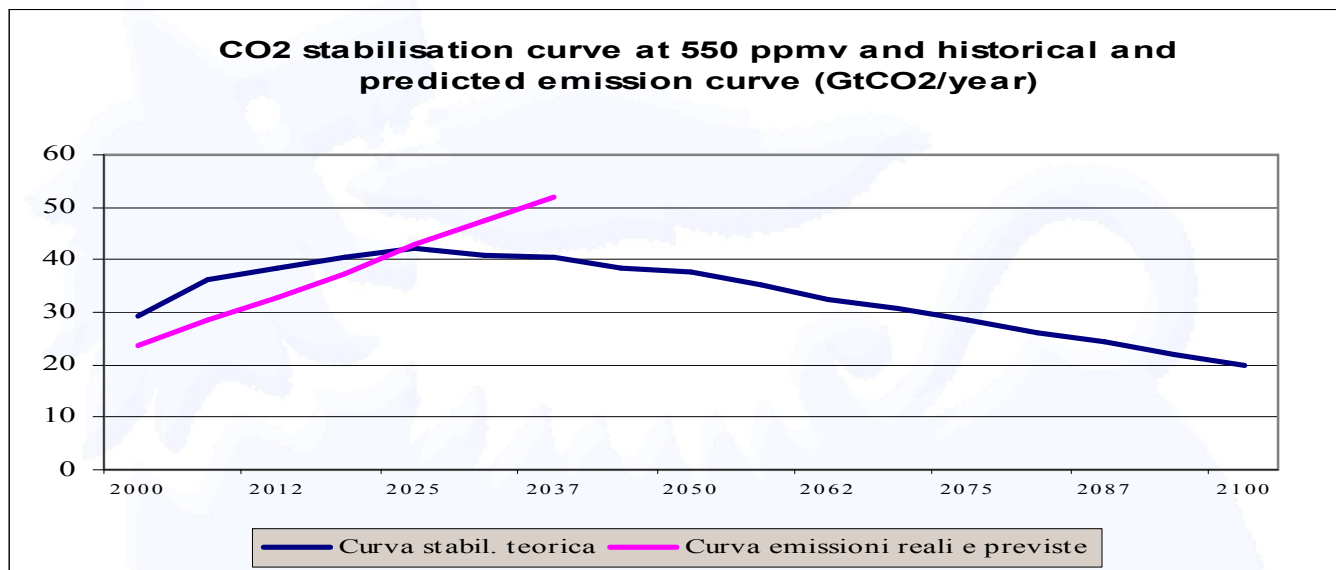
RISKS FROM CLIMATE CHANGE: the Carbon Constraint

ADDITIONAL DRIVERS

THE PATHWAY TO CHANGE

Eni GHG ACTION THE CASE: THE CASE OF NIGERIAN IPP

THE "CLIMATE CHANGE" RISK : THE CARBON CONSTRAINT



Source: IPCC 2001

THE RISK FOR OIL COMPANIES (AND PRODUCING COUNTRIES)

Stabilization of CO₂ concentration in the atmosphere



Contraction of fossil fuels market



Higher competition between fossil fuels and operators

Potential market

Market contraction due to emission limits



Profit loss = barrel margin x market contraction

Higher competition among operators



Reduction of margin per barrel

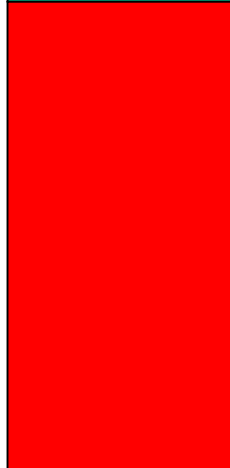


Contraction of profit and reduced profitability of E&P project

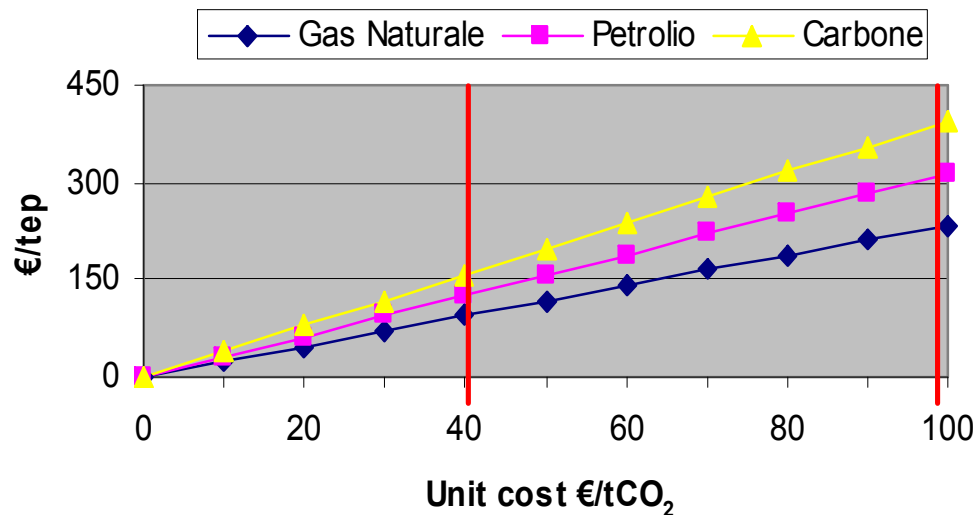


Reduction of the business value

Residual market



CO₂ cost internalization

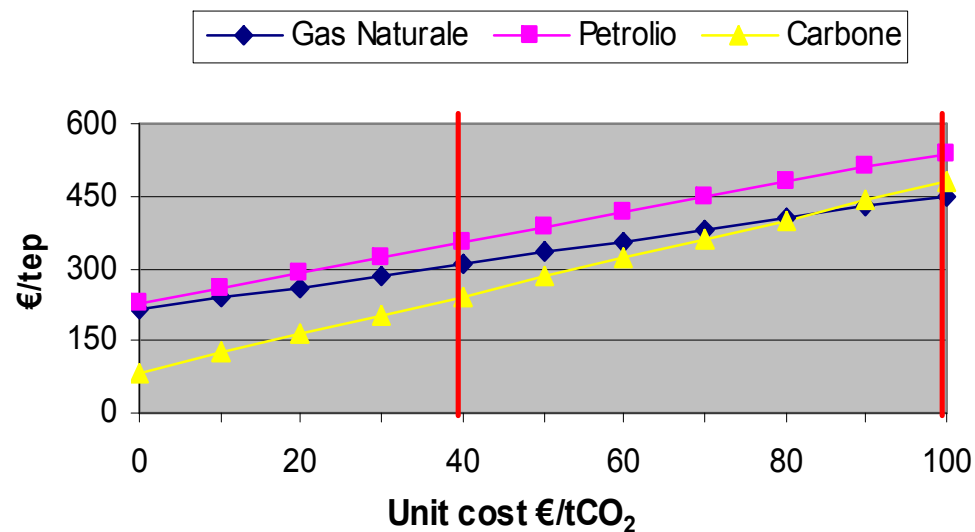


The internalization of the environmental cost of CO₂ may substantially increase the total cost of the primary energy and change the competition among fuels, conversion technologies and final uses.

CO₂ EMISSION FACTORS

	tCO ₂ /toe	tCO ₂ /MWh
Natural gas	2,35	0,36
Oil	3,15	0,65
Coal	3,96	1,00

Total cost of primary fossil fuels



DRIVERS FOR CHANGE OF THE ENERGY SYSTEM

GHG MITIGATION

A NEW ENERGY SYSTEM

LESS CARBON INTENSIVE

DEMAND SPIKES

**ABLE TO MATCH THE
INCREASING DEMAND**

PRICE ESCALATIONS

**AFFORDABLE AND
STABLE**

SUPPLY SECURITY

MORE SECURE

Regulatory Framework

- ✓ The Kyoto Protocol (KP) will put GHG emission reduction targets on many of the countries in which Eni operates
 - About 50% of the Eni GHG emissions subject to ET (58 installations)
 - Opportunity from CDM & JI projects (most from Flaring Down)
- **The EU Emissions Trading Scheme:** close to start
 - The installations involved have strict requirements in terms of monitoring and reporting of GHG emissions (**Guidelines C(2004) 130 final, 29 January 2004**)
 - GHG emissions data and reports shall be verified

EU Ancillary Legislation

Integrating the environment into EU energy policy

- ❖ Emission Trading Scheme and Linking Directive (CDM/JI)
- ❖ Cleaner Transportation Fuels and sustainable mobility
- ❖ CO₂ limit to road vehicles (120 gCO₂/km ?)
- ❖ Energy efficiency
- ❖ Combined Heat Power
- ❖ Eco-labelling programmes: household appliances, Energy Star Logo, hot water boilers, domestic refrigeration, fluorescent lighting
- ❖ Improved building regulations: energy performance, energy certification
- ❖ Renewables at 12% by 2010
- ❖ Electricity from Renewables: 22,1 % of total Power Generation by 2010 (green certificates)
- ❖ R&D funding for low-carbon technologies
- ❖ Eco-Taxes, to protect the environment
- ❖ Strategy for Sustainable Development: prices need to reflect environmental costs, global partnership for SD
- ❖ Security of energy supply: new import routes for oil & gas, nuclear energy

PATHWAY TO GHG MITIGATION

- **Natural gas fuel of choice, due to lower carbon content.
Expansion in power generation with CCGT**
- **Crude oil progressively restrained to obligatory oil products.
Demand for cleaner fuels (low sulphur content)**
- **Internalization of GHG emissions**
- **Search for a technology fix to the CO₂ issue: geological sequestration; CSLF, Carbon Sequestration Leadership Forum**
- **Zero Gas Flaring: Global Gas Flaring Reduction (World Bank)**
- **Search for and Deployment of Sustainable Renewables**

Eni GHG Action Plan

- ❖ “Eni Action Plan on Kyoto Protocol and Flexible Mechanisms”
 - Task A – GHG accounting
 - Task B – GHG certification
 - Task C – Emission Trading
 - Task D – CDM and JI projects
 - Task E – Carbon Management Strategy
- ❖ WG Cost Saving (and GHG reduction)
- ❖ WG Gas Flaring/Venting down
- ❖ R&D activities: CO₂ Capture Project, 6° Framework Program, National Program “Hydrogen Vector and Fuel Cells”
- ❖ Development of a model of a sustainable energy system and definition of the transition path
- ❖ Plan of Eni actions (GHG reduction via energy conservation, CDM/JI projects, Waste to Energy, CO₂ Sequestration, Renewables)

CARBON MANAGEMENT STRATEGY – Short/Medium Term

Short – Medium Term

- Engage in
 - EU Emission Trading Scheme
 - Joint Implementation (JI)
 - Clean Development Mechanism
-
- Integrate Carbon Management in the Eni business
- Support national efforts towards Kyoto compliance (Voluntary Agreement with the Italian Ministry of Environment)
- Design a long term sustainable energy system and related R&D

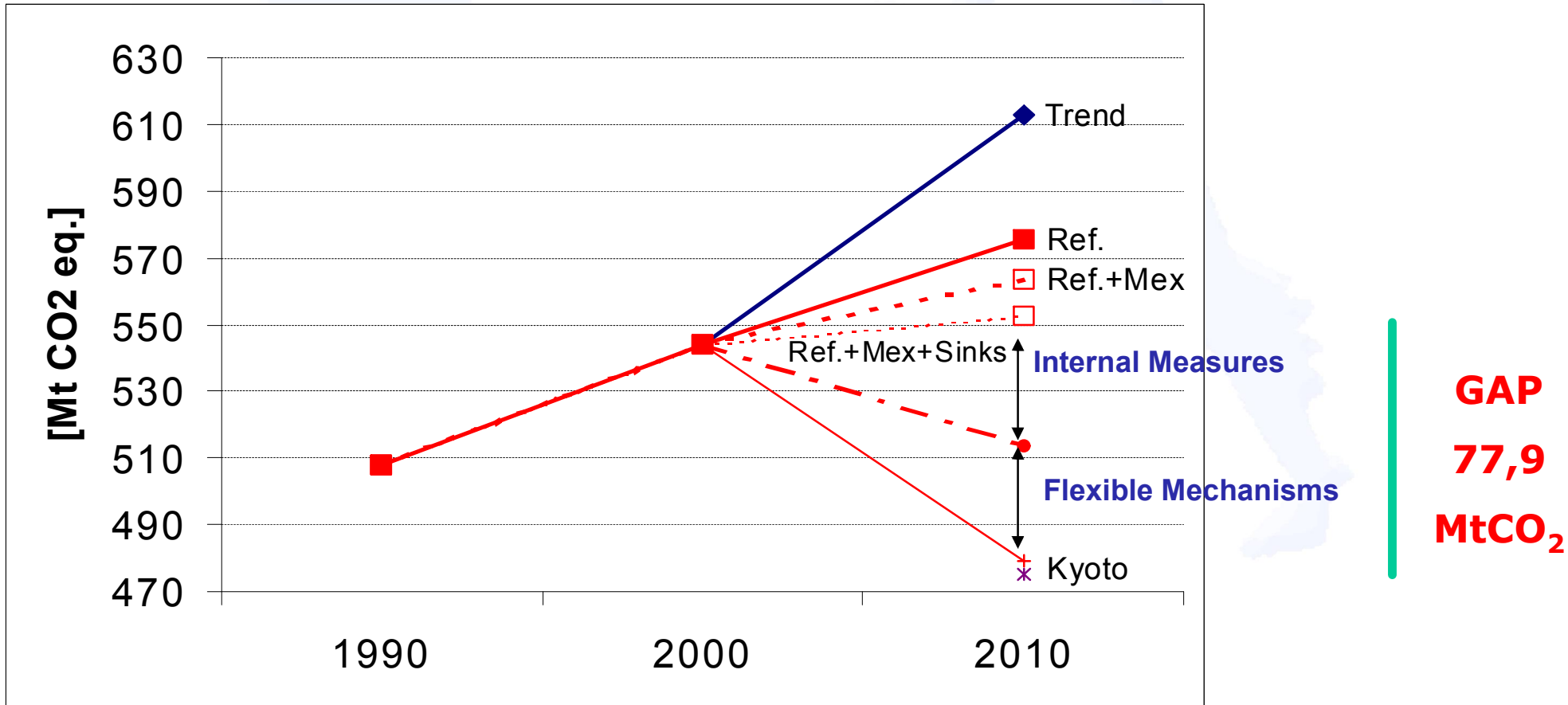
Long Term

- Adapt to a Carbon constrained scenario
- Develop, demonstrate and deploy sustainable energy technologies: CO₂ sequestration, sustainable renewables

CLIMATE CHANGE: IMPACT ON Eni GROUP

- **PARTICIPATION TO THE EMISSION TRADING SCHEME**
 - ❖ 55 installations in Italy
 - ❖ 3 in other EU countries
- **CDM/JI OPPORTUNITIES TO SUPPORT THE VOLUNTARY AGREEMENT BETWEEN Eni AND THE ITALIAN MINISTRY OF ENVIRONMENT TO USE THE KP FLEXIBLE MECHANISMS**

Italian Distance from the Kyoto target



CDM/JI OPPORTUNITIES

Linking Directive: allows to convert CERS and ERUs from CDM and JI projects into EU allowances, without limits.

Zero Gas Flaring: E & P is member of the Global Gas Flaring Reduction, which aims to a gradual elimination of routine flaring.

Opportunities arising from core business projects.

Expected simplifications, at the next COP10, of the CDM/JI Mechanisms.

Nigeria Macroeconomic Oil&Gas Sector

COUNTRY DATA

Population:	> 140 million
GNP:	72 Billion US\$
GNP per capita:	500 US\$
GNP growth rate:	3.7 %
Inflation rate:	15.0 %
External Debt:	33.0 Billion US\$

In the year 2005 the external debt reduced to 5B\$ after Paris Club approval

UPSTREAM SECTOR

Oil production:	2.4 MBOPD
Gas production:	7.5 BSCFD
Total Production:	3.8 MBOEPD
Oil Reserves:	30.0 BSTB
Cond. Reserves:	5.0 BSTB
Gas Reserves:	180.0 TSCF
Revenue 2005 from oil&gas export:	27.0 B US\$

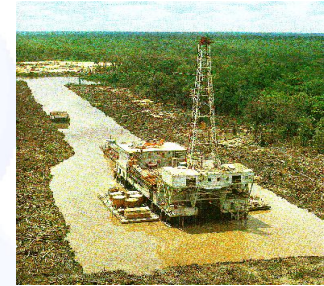
Oil and Gas revenues represent 90% of foreign exchange earning and 38% of GDP.

The Central Bank of Nigeria, Annual Report ; IMF Annual Report

NNPC, Monthly Petroleum Information

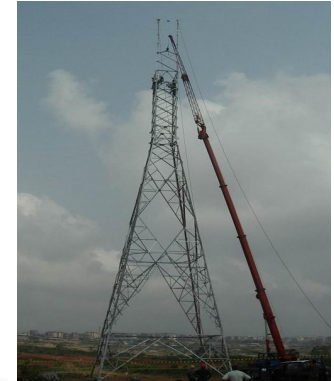
History Of Eni In Nigeria

- **1962** **ESTABLISHMENT OF "NIGERIAN AGIP OIL COMPANY"**
NAOC STARTS EXPLORATION ACTIVITIES
- **1973** **FIRST JV WITH NIGERIAN GOVERNMENT**
(60% NNPC)
- **1976** **ELECTRIC POWER SUPPLY TO BRASS COMMUNITY**
- **1980** **ESTABLISHMENT OF AENR Ltd**
- **1985** **GAS RE-INJECTION IN OBIAFU-OBRIKON PLANT**
- **1989** **NAOC ACQUIRES 5% OF THE SHELL ASSETS**
(INCREASE OF ABOUT 60,000 BOPD EQUITY)
- **1989** **ESTABLISHMENT OF "NIGERIA LNG Ltd" (AGIP 10.4%)**



History Of Eni In Nigeria

- 1994 **FIRST** NGL SUPPLY TO ELEME PETROCHEMICAL
- 1996 ESTABLISHMENT OF NAE Ltd
- 1997 RENEWAL OF NAOC JV OMLs UNTIL YEAR 2027
- 1999 NAOC PROVIDES **FIRST** GAS FOR N-LNG PLANT.
- 2000 NAOC DEFINES A PLAN TO REACH "ZERO FLARING"
- 2001 NAOC SIGNS THE **FIRST** ELECTRIC POWER SALE AGREEMENT FOR AN INDEPENDENT POWER PLANT (IPP) AT OKPAI
- 2003 START UP OF ABO FIELD, **FIRST** DEEP WATER OFFSHORE
- 2003 ESTABLISHMENT OF "BRASS LNG Ltd" (Eni 17 %)
- 2005 START-UP OF OKPAI IPP (**FIRST** IPP in Nigeria)

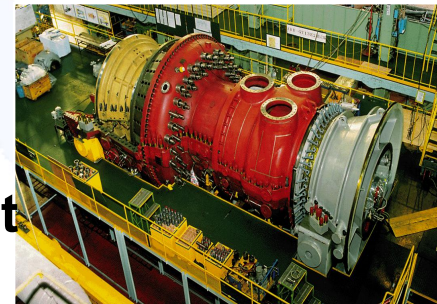
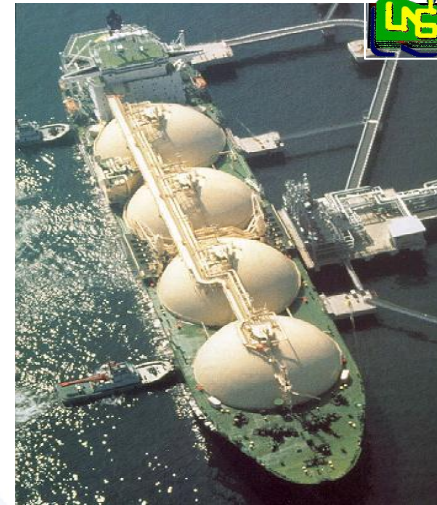


Eni: Integrated Business in Nigeria

Milestones

Business integration

- 1989:
Nigeria LNG Ltd established
- 1994:
Eleme Petrochemical integrated project
- 1999:
Bonny LNG plant start-up
- 2001:
Independent Power Plant Project. First electricity April 2005
- 2003:
Brass LNG company incorporated



Eni: Solid Relationship With Local Communities

Milestones

Social and
Environmental
commitment

- 1976: 1st social project – Power supply to Brass Community
- 1985:
Reducing gas flaring through gas re-injection
- 1987: Green River Project
- Multiple power supply to Communities
- 2000:
Start of “zero gas flaring” project
- 2001 :
Roll-back malaria, Burma Rice



2008
Target



<5%



<5%

Utilization of Associated Gas

View of Nigerian flares as seen from the satellite
An unusual brightness in the dark of the African continent

Nigeria produces 2.3 M Bopd of oil and 6 BScf/day of associated gas.

About 45% of produced gas is presently flared.

Gas reserves of the country is estimated to be 180 Tcf

The government through fiscal incentives has opened new markets

The exportation of liquefied natural gas (N-LNG) commenced in 1999

Government defined Zero flaring objective for 2008



Nigerian Zero Flaring Gas Master Plan

NAOC's Strategy for Zero Flaring

GAS SUPPLIES

to N-LNG:

Trains 1 & 2

Train 3

Trains 4 & 5 (Jul. – Dec. 2005)

Train 6 (end 2007)

to Brass LNG (4th QR 2009)

to IPP:

Okpai – Phase 1

Okpai – Phase 2 (end 2007)

to Rivers State Gov. Power Plant

to Eleme Petrochemical:

Fuel Gas

NGL

GAS INJECTION

Kwale field

Ob/Ob field

INTERNAL CONSUMPTIONS

Fuel Gas

for power generation

for gas turbines drivers

Original Plan: Zero Flaring within 2008

**Budget
Constraints**

Projects Delay

**Screening &
Optimization**

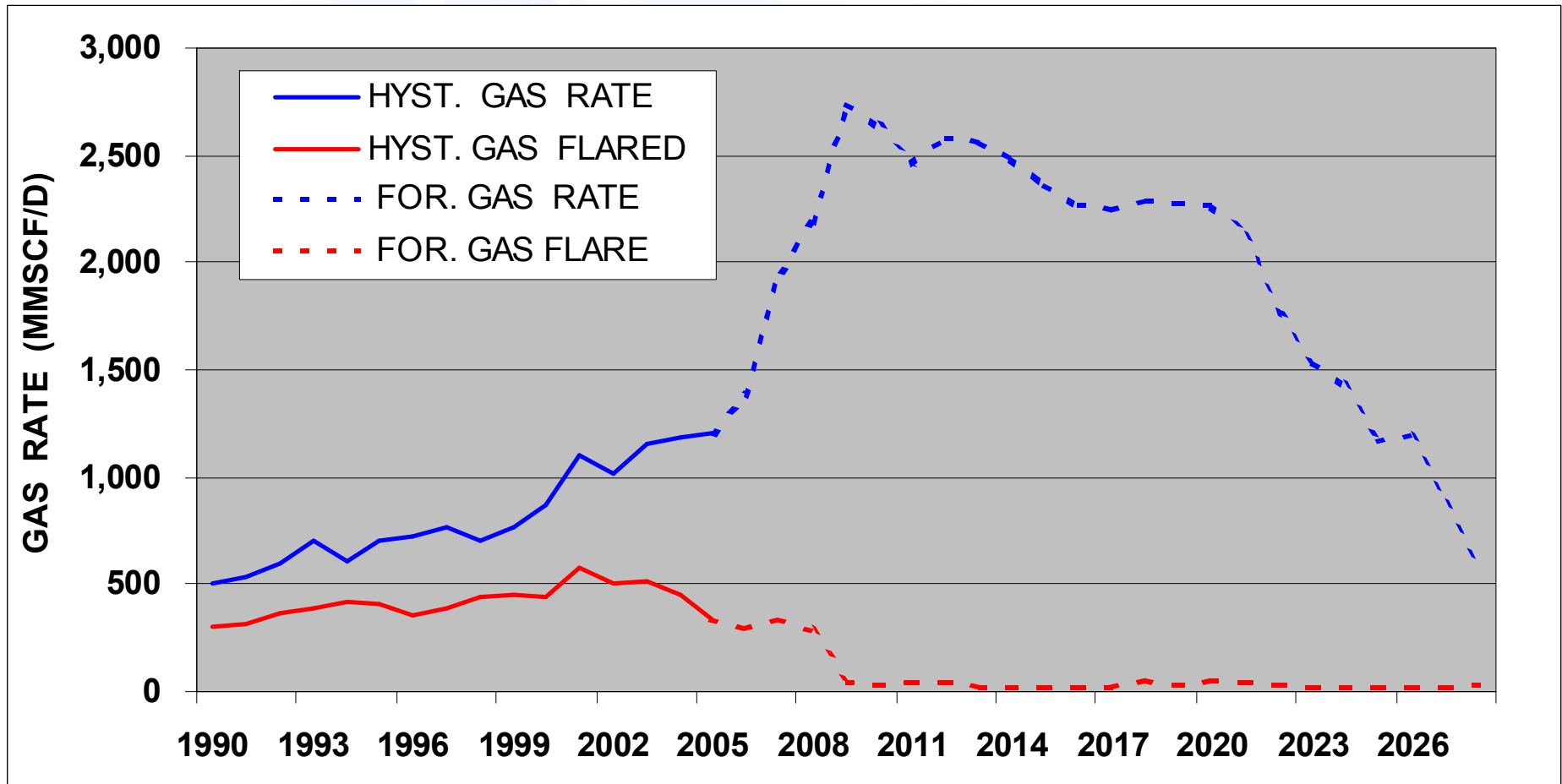
NAOC has endeavoured to minimize the negative effect of NNPC's budget limitations.

Expected Situation in 2008

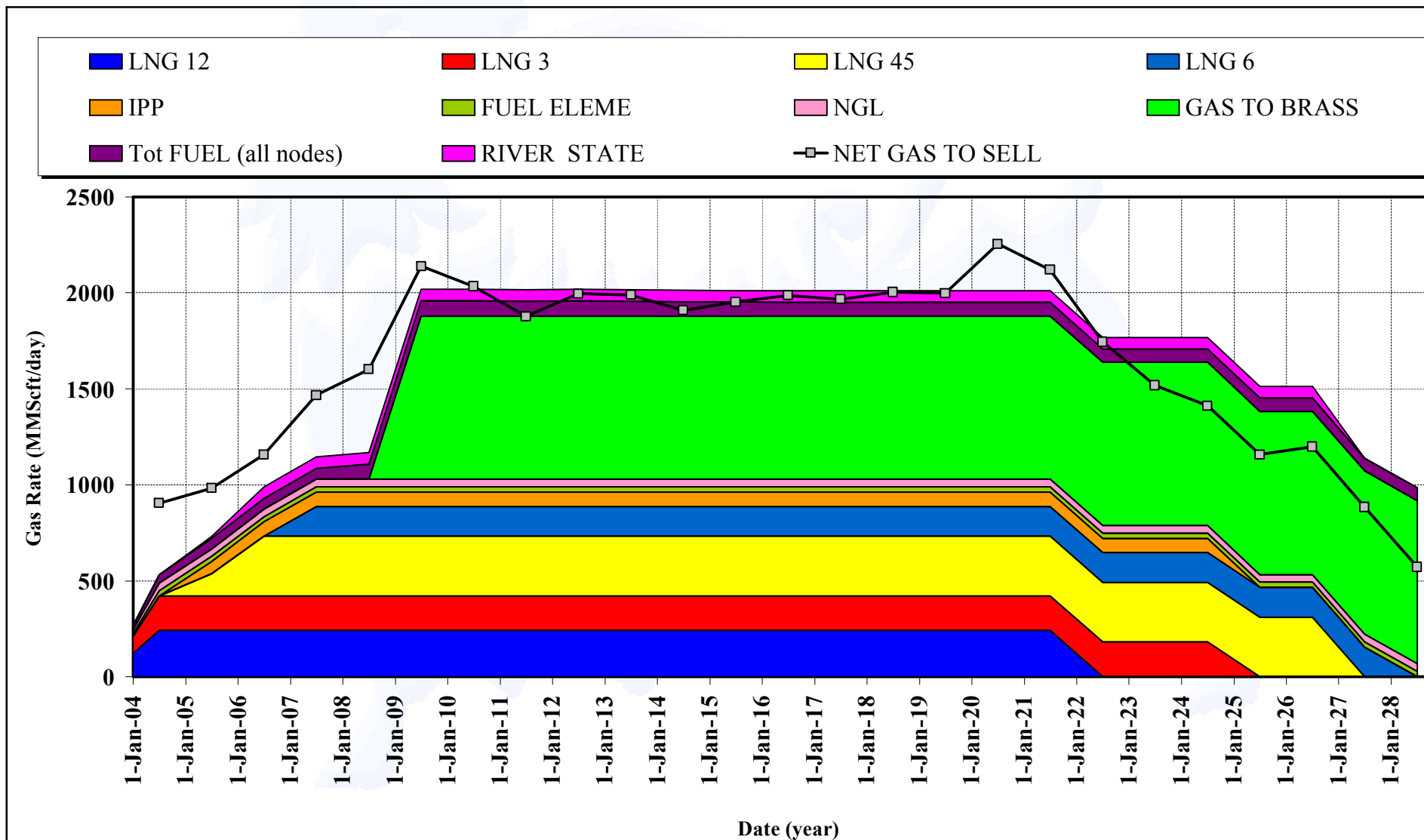
Flaring: approx. 10 % of the total produced gas

Final Zero Flaring by the end of 2009

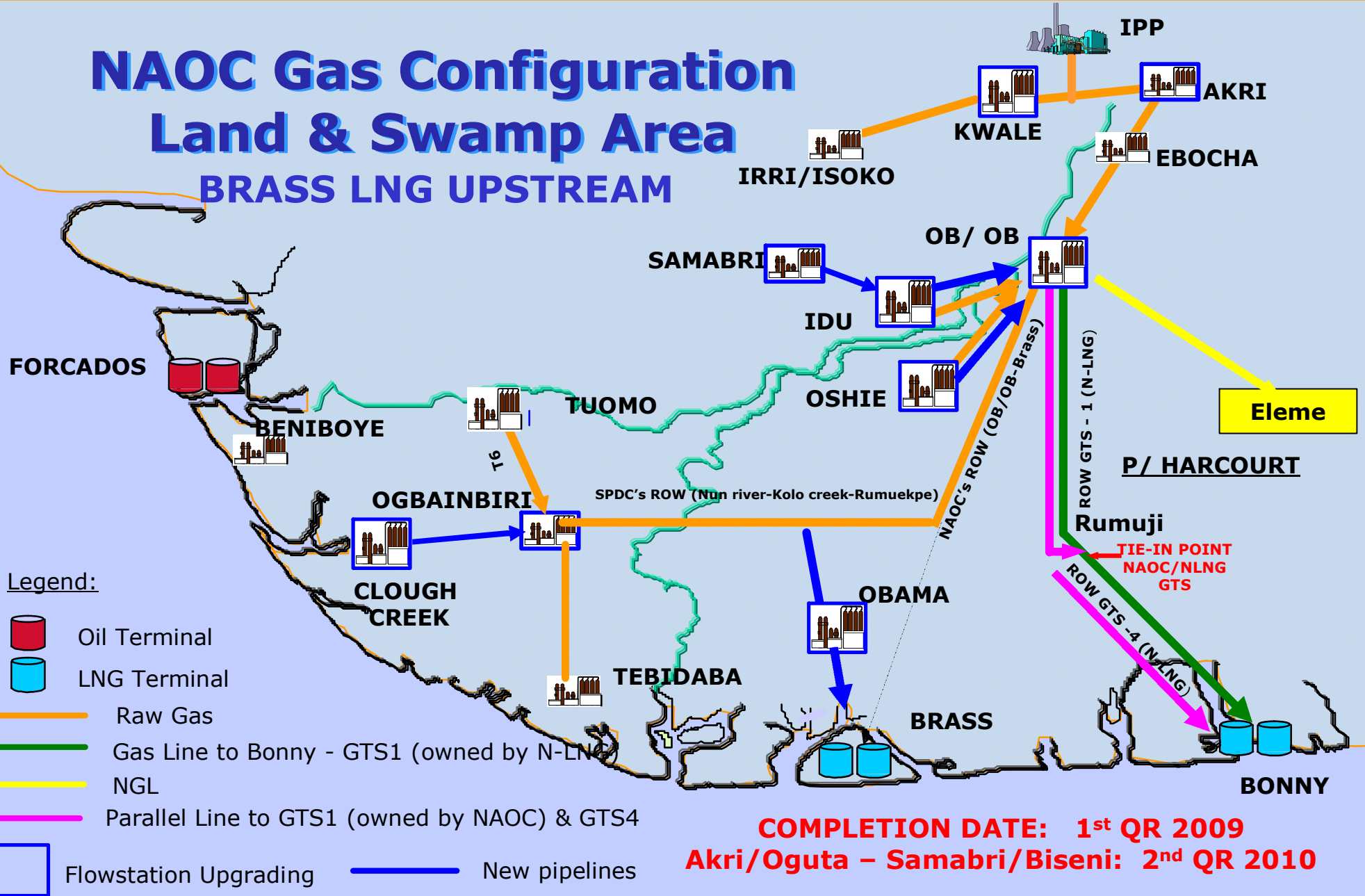
Gas Flaring Trend



Gas Utilization



NAOC Gas Configuration Land & Swamp Area BRASS LNG UPSTREAM





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1. Description of the project

Purpose/Activity: The Okpai IPP is a high efficiency combined cycle gas turbine electricity generating plant.

The project consists of taking medium and low pressure associated gas trains from the Kwale OGPP* which were previously **flared** upon separation from oil (*in absence of any economically viable, commercial outlet*) and transporting the gas 14 km along a pipeline for use in power generation at a CCGT IPP located at Okpai.

***Kwale OGPP:** It is where the oil gas processing plant is located and where the majority of the flaring occurs

Location: The associated gas used in the Okpai IPP is produced at oil field operated by NAOC in the Oil Mining Lease area 60 (OML60), delta State, **Nigeria**.

IPP Project Partners: NNPC (60%);



NAOC (20%); PONL (20%).

1. Description of the project

Techonology: The project involves the use of the following technologies:

- gas dehydration, taking up ullage at the existing Kwale OGPP;
- gas compression and a 14 km pipeline inter-connector from the Kwale OGPP to the IPP at Okpai.
- *(a 480 MW combined cycle gas turbine power plant)*

Boundaries: is the estimated margin around the project, within which the project's impact (in terms of GHG emission reductions) will be assessed.

The project boundary is considered to be the following:

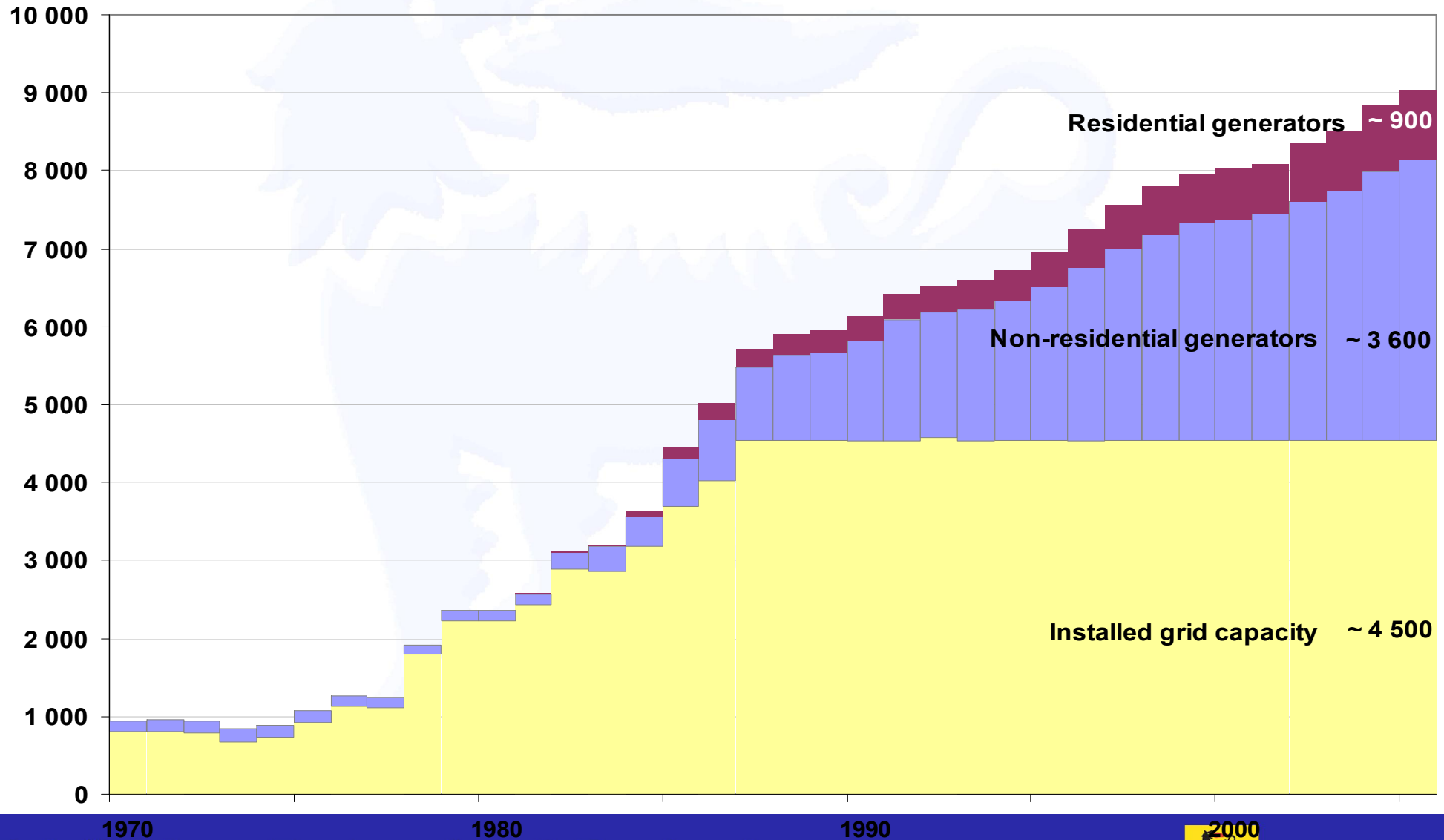
- The Kwale OGPP;
- The pipeline inter-connector between Kwale OGPP and the IPP

N.B Emissions from the IPP are considered outside the boundaries of the project activity: leakage.

Crediting period : it defines the period over which emission reductions of the project can be claimed. : **10 years (2006-2015)**

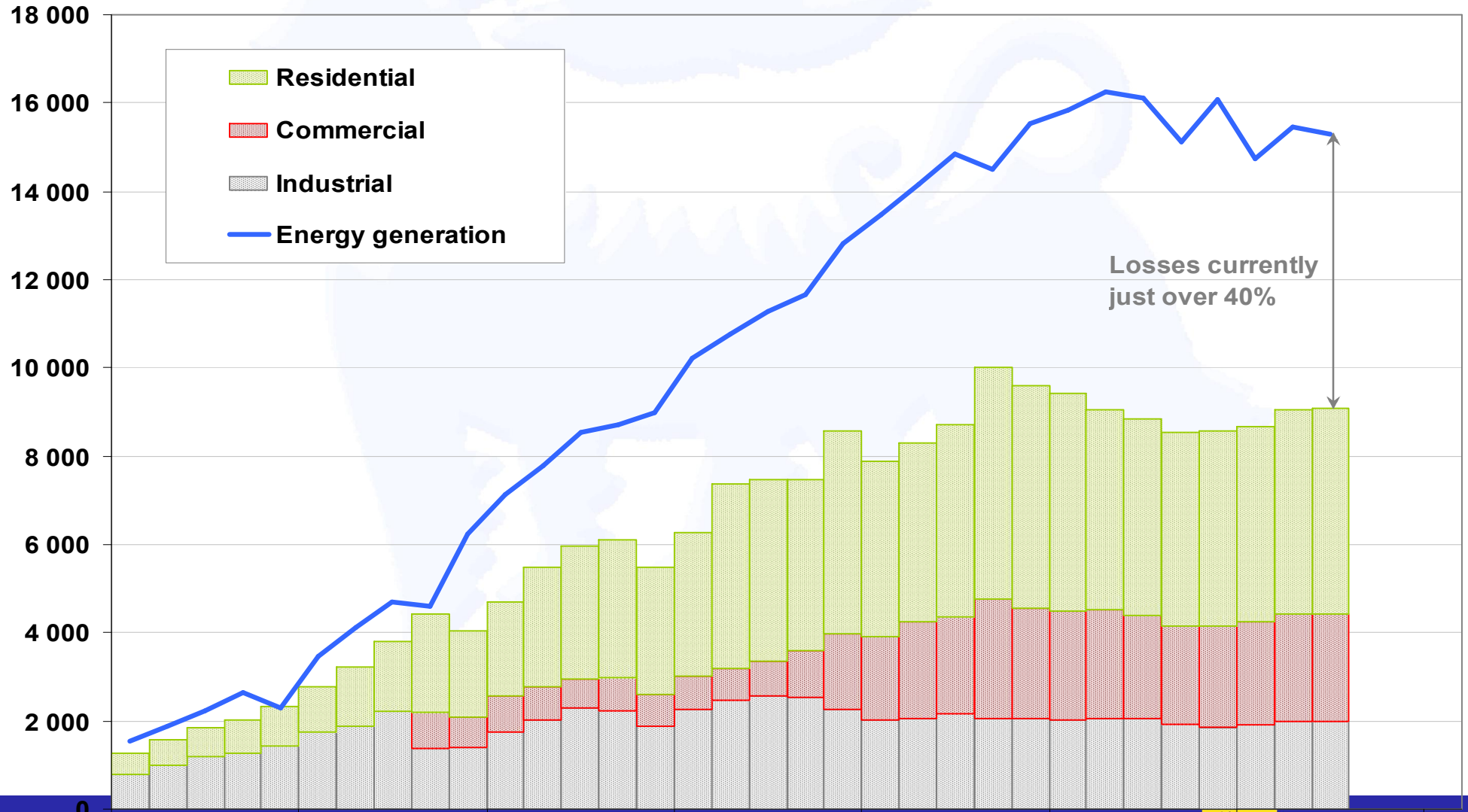
Current and historical on- and off-grid generation capacity in Nigeria

Capacity (MW)



Historical on-grid energy consumption by sector, losses and energy sent out in Nigeria

Energy sent out GWh



Losses currently
just over 40%

2. Baseline and baseline methodology

Baseline: It is the scenario that reasonably represents the anthropogenic emissions by sources of GHG that would occur in the absence of the proposed project.

The baseline is equal to the emissions equivalent from flaring of the volume of gas recovered from the oil wells in OML 60 (Point A), less the following sources:

- The volume of dry gas which is exported in the high pressure gas train from Kwale OGPP to Ob/Ob GPP (point B1).
- The volume of dry gas which is exported for reinjection at OML 60 (Point C)

Baseline Methodology: Approved methodology AM0009 version 02 :

"Recovery and utilisation of gas from oil wells that would otherwise be flared." .

The methodology involves the application of *ex post monitoring* of various carbon flows across the gas recovery, processing, export, and emergency relief (flares) systems, plus any accidental releases through plant or pipeline failure.

2. Baseline and baseline methodology

1. Energy required for transport and processing of the recovered gas is generated by using the recovered gas;
2. **The products will substitute only the same types of fuels or fuels with a higher carbon content – current electricity generating mix in Nigeria is oil: 6.3%, natural gas: 56.9%; Hydro: 36.8%, and the Nigerian government's energy strategy outlines plans to increase the use of natural gas in power generation.**
3. The substitution of fuels due to the project activity is unlikely to lead to an increase of fuel consumption in the respective market;
4. In the absence of the project activity, the gas is mainly *flared*;
5. Data is accessible on the products of the gas processing plant and on the gas recovered from other oil exploration facilities in cases where these facilities supply recovered gas to the same processing plant .

3. Emission reductions: Additionality

Alternative	Legal aspects	Economical attractiveness	Conclusions
Option 1: Venting	Prohibited by law and internal Eni guidelines	Highly attractive	Not feasible
Option 2: Flaring	Prohibited by law. Non-compliance is widespread.	Highly attractive. Fines for flaring are far lower than the financial risks involved with other recovery investment options	Current practice
Option 3: Onsite use	Not prohibited	Already carried out. Significant supply surplus relative to onsite power demand	Currently practised. No scope to increase onsite use.
Option 4: Injection	Not prohibited	Already carried out. No scope to increase the volume of gas reinjection without prohibitively high financial costs.	Currently practised. No scope to increase volumes injected
Option 5: Recovery and distribution	Not prohibited	Unattractive There is limited local market for gas. Investment risks associated with gas infrastructure are high. Limited potential for use in LNG	Not feasible. Would require creation of end market with guaranteed revenue stream.

3. Project Emissions

1. Emissions from the Kwale gas processing plant – including emissions from onsite energy use that are attributable to the medium and low pressure gas trains exporting to the Okpai IPP;
2. Fugitive and accidental emissions from the transportation of gas to the Okpai IPP;
3. Emissions the flaring of blow down from the Okpai IPP pipeline.

RESULTS FROM CALCULATIONS:

Emission Reductions over the crediting period : **14,969,337** tonnes CO₂eq.

CONCLUSIONS

- **The Oil & Gas sector – companies and producing countries – must cope with the challenges of GHG mitigation**
- **Possible responses**
 - ❖ **NG fuel of choice. Development of NG production and supply (long distance pipelines; LNG; gas-electricity integration)**
 - ❖ **Promote Zero Gas Flaring**
 - ❖ **Demonstration of CO₂ sequestration**
 - ❖ **Deployment of Sustainable Renewables**
- **Flexible Mechanisms: important bridge between Annex I and non Annex I countries. COP10 is an important opportunity to strengthen CDM and launch JI**